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ABSTRACT

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LEARNING VOCABULARY FROM CONTEXT: EFFECTS OF FOCUSING ATTENTION ON INDIVIDUAL WORDS DURING READING

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November 1995

Center for the Study of Reading

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Abstract

This study investigated the effects of systematically varying the vocabulary-related instructions that students receive before reading to further understanding of the vocabulary/comprehension relationship. Subjects were 299 students from fifth- or fourth/fifth-grade classrooms, who participated in six different conditions which included reading passages with underlined words, reading and underlining difficult words, and trying to learn meanings from context. Posttest results indicated that the manipulation of the instructions given to students before reading did not influence their vocabulary learning during reading. Students of all ability levels increased their knowledge of the target vocabulary words as a result of reading passages in which the words appeared, regardless of the instructions given prior to reading.

INTRODUCTION

The strong correlational relationship between vocabulary knowledge and reading comprehension has long been acknowledged. Even the McGuffey Readers reflect the belief that the ease or difficulty of comprehending reading materials can be attributed primarily to the difficulty of the vocabularies they contain (Gray, 1937; Venezky, 1984). In addition, the strength of this correlational relationship has been well documented over the years and has often been interpreted to mean that vocabulary knowledge enables comprehension (Davis, 1944, 1968; Dixon, LeFevre, & Twilley, 1988; Spearritt, 1972; Thorndike, 1973; Thurstone, 1946). Because of this, vocabulary knowledge receives a great deal of attention in most basal reading programs. Focus on vocabulary knowledge in reading programs has taken many forms, ranging from instruction on individual words, to highlighting of difficult words in texts, to instruction on strategies for learning words from context. All of these activities take place with the intention of promoting better reading comprehension.

Not only is increased vocabulary knowledge associated with better reading comprehension, but vocabulary knowledge is also acquired incidentally during everyday reading (Anderson & Freebody, 1983; Jenkins, Stein, & Wysocki, 1984; Nagy, Anderson, & Herman, 1987; Nagy & Herman, 1987; Nagy, Herman, & Anderson, 1985; Sternberg, 1987). In other words, there is a reciprocal relationship between vocabulary knowledge and reading comprehension--more vocabulary knowledge generally leads to better reading comprehension, which, in turn, results in increases in vocabulary learning (Stanovich, 1986). Incidental acquisition of vocabulary knowledge during reading is one explanation given for the tremendous growth of children's vocabulary knowledge during their school years, as many as 3,000 words annually (Nagy & Anderson, 1984; Nagy et al., 1987; Sternberg, 1987). In fact, most vocabulary growth can be attributed to learning from context while reading (Nagy et al., 1987; Sternberg, 1987). However, conditions which have the potential to influence incidental acquisition of vocabulary knowledge during normal reading have not been explored systematically.

Learning vocabulary from context has dominated the concerns of many researchers. Some have focused on the effects of different types of contexts, usually specifically constructed for research purposes, on vocabulary learning (Carnine, Kameenui, & Coyle, 1984; Herman, Anderson, Pearson, & Nagy, 1987; McKeown, 1985), while others have documented children's ability to learn vocabulary from naturally occurring text during normal reading (Nagy et al., 1985; Nagy et al., 1987). The results of different lines of research have been mixed; sometimes students clearly demonstrate learning from context and sometimes they don't. One possible explanation for the inconsistencies lies in the distinction between deriving word meanings, purposely trying to figure out word meanings from context, and incidentally acquiring word meanings from context as a by-product of reading. Because this distinction has never been examined systematically, the next logical step in this line of research is to examine the effects of exposing children to conditions in which their attention is focused, either explicitly or indirectly, on learning difficult vocabulary during reading.

The primary purpose of this study was to investigate the effects of systematically varying the vocabulary--related instructions that students receive before reading, with the goal of furthering our understanding of the vocabulary--reading comprehension relationship. The effects of focusing students' attention on difficult vocabulary, either directly or indirectly, on their learning of that vocabulary was also examined. Several key issues must be taken into consideration in the examination of the effects of manipulating the focus of attention during reading. These issues include the pervasive effect of general verbal ability, the possible negative consequences for comprehension of directing attention to individual words, and the incremental nature of vocabulary growth.

The effects of general verbal ability warrant careful consideration because of the inconsistent results of previous research. Some studies (Herman et al., 1987; Jenkins et al., 1984; Werner & Kaplan, 1952) seem to suggest that younger or less able children are not capable of inferring the meanings of new

words from context with any degree of accuracy, while others (Nagy et al., 1985; Nagy et al., 1987), found the interaction between vocabulary learning and verbal ability not to be significant. This relationship merits further exploration because of its important instructional implications. If incidental vocabulary acquisition during reading is uniquely characteristic of students of high verbal ability, then other specific methods of vocabulary acquisition may need to be explored for students of lower verbal ability. However, if this differential effect of vocabulary learning from context does not exist, then students of all abilities could be expected to benefit from efforts to simply increase the amount of reading that they do.

The relationship of vocabulary learning to passage comprehension also needs to be taken into consideration. Because the ultimate goal of vocabulary instruction is to enhance reading comprehension, care must be taken to ensure that any program undertaken to increase vocabulary knowledge does not also negatively affect reading comprehension. For example, directing students' attention to underlined words in a passage might aid word learning, but it might also disrupt comprehension.

A third issue that must be addressed in any study of vocabulary learning is the possibility that vocabulary acquisition may be incremental in nature. Word knowledge is generally acquired in small increments, and a person's knowledge of a word is likely to be at different stages for different words at any given time (Anderson & Freebody, 1983; Curtis, 1987; Dale & O'Rourke, 1986; Nagy & Herman, 1987). It has been hypothesized that discrepancies among results in previous studies may be attributed to the incremental nature of word learning when word knowledge is examined at only two levels--present or absent. It may be that an assessment that is sensitive to partial word knowledge can capture the small changes in knowledge that occur naturally during reading.

While research has begun to address issues related to learning vocabulary from context, there are some important points that need to be investigated before the results of the research can be applied effectively to classroom practice. The possible reasons for inconsistencies in the research on learning and deriving word meanings need to be explored before making recommendations about the most effective ways to promote independent word learning. In addition, assessments need to be developed that, because they allow examination of different levels of word knowledge, will be sensitive to small changes in word knowledge that may occur as a result of exposure to different interventions.

This study specifically addresses these questions:

1. Is the learning of vocabulary from context a replicable phenomenon?

2. Do the instructions that students are given before reading, either directly or indirectly focusing their attention on difficult vocabulary, differentially affect learning of that vocabulary?

3. Is the learning of vocabulary under different conditions affected by the student's verbal ability?

4. Is the relationship between passage comprehension and vocabulary learning differentially affected by the instructions students are given before reading?

METHOD

Subjects

The 299 subjects in this study were from four schools in a midwestern city. The students were from 12 intact classrooms: 11 fifth-grade and 1 fourth/fifth-grade split class. Five fifth-grade classrooms and the split classroom were in School A. Two classrooms each in schools B, C, and D also participated. The school and district demographic data are displayed in Table 1. The students in one of the fifth-grade classrooms were classified as gifted, and were bussed in from the entire district. Students in all the other classrooms were heterogeneously grouped.

[Insert Table 1 about here.]

Design

The students read the passages under different conditions. The conditions were determined by the directions that the students were given before reading a passage. Each student was assigned to one of six conditions and read two passages in that condition. The directions for the six conditions were:

> Condition 1. Read the story (article).
>
> Condition 2. Read the story (article). Try to understand the important ideas in the story (article).
>
> Condition 3. Read the story (article). While you are reading the story (article), *underline* the words that you think are hard. A word is hard if you do not know what it means, or if you do not know very much about it.
>
> Condition 4. Read the story (article). (In this condition the target words were already underlined for the student.)
>
> Condition 5. Read the story (article). Try to learn what the words that are *underlined* mean as you read the story (article).
>
> Condition 6. Read the story (article). While you are reading the story (article), underline the words that you think are hard. A word is hard if you do not know what it means, or if you do not know very much about it. Try to learn what the hard words mean as you read the story (article).

Because stratified random assignment to conditions within classrooms was used, students within the same classroom received different conditions and forms that reduced the possibility of successful copying from one another. The students were instructed to read the directions carefully before reading the passage. Any questions the students had were answered individually. As in the pretesting session, the students were allowed to take as much time as they needed to complete the tasks. Each of the posttesting sessions lasted about 30 minutes.

Materials

Reading passages. The four fifth-grade passages selected from grade-level books used by Nagy et al. (1987) were used in this study. We selected these passages because Nagy et al. determined that there were relatively similar rates of vocabulary learning from context for each of the four passages. There were two narrative passages, one difficult and one easy, and two expository passages, one difficult and

one easy. The 15 most difficult words from each passage (based on teacher ratings) were selected as the target words.

Tests

Yes/no test. As a part of the pretest, each student completed a yes/no vocabulary test. The scores on this test were used as a measure of general verbal ability. The test was constructed following the guidelines established by Anderson and Freebody (1983). Forty real words, representing a wide range of difficulty, were selected from Levels E through J of the *Comprehensive Tests of Basic Skills* (CTBS) (1981). In addition, 36 nonwords were constructed. As suggested by Anderson and Freebody, three categories of nonwords were constructed--decoding distractors, pseudo-derivatives, and words with English-like spellings. Two forms of the test, differing in terms of the order in which the words were presented, were used. The students were instructed to read each word and to circle it if they knew the meaning or to cross it out if they did not know the meaning. The yes/no test was scored using the procedures outlined by Anderson and Freebody.

Vocabulary test. Because of the possibility that vocabulary acquisition may be incremental in nature, it is important to have measures of vocabulary knowledge that are sensitive to different levels of word knowledge. While students may not be able to demonstrate complete knowledge of a word's meaning after being exposed to it, either during a natural reading situation or through an instructional intervention, they should be given credit for smaller gains in their knowledge of the word's meaning. Based on the results of an earlier validation study (Stallman, Pearson, Nagy, & García, 1990), the Contexts Test format was used for the vocabulary test. For the Contexts Tests format, four questions--each of which required different levels of vocabulary knowledge--were constructed for each target word. For example:

Do toss like to fish?	Yes	No	Don't Know
Can a bell toss?	Yes	No	Don't Know
Is tossing a way of throwing?	Yes	No	Don't Know
Is tossing something you do gently?	Yes	No	Don't Know

The questions were presented in a random order to the students. The Contexts Test was scored in the following manner. Students received 1 point for choosing a keyed response, 0 points for choosing *don't know*, and -1 point for choosing a response that was not keyed. This test was used for both the pretest and posttest. Four forms that differed in terms of the order of presentation of the items were used for the pretest and four additional forms were used for the posttest. A total of eight different forms were used in the study. No student saw the items in the same order on the pretest and posttest.

Comprehension test. A measure of passage comprehension was constructed for each passage. This test was developed based on the guidelines used to create the reading test portion of the Illinois Goals Assessment Program (Illinois State Board of Education, 1994). Five items were constructed for each passage. Each item had either 1, 2, or 3 correct answers, and varied in the amount of inference required to select the correct response. The levels of questions included were:

1. Explicit (the information required to answer the item was explicitly stated in the text).

2. Inference I (the information required to answer the item was in one paragraph, but required an inference).

3. Inference II (an inference across more than one paragraph was required to answer the item).

4. Inference III (an understanding of the overall point of the passage was required to answer the item).

Because a multiple right answer format was used, an individual stem could have answers that were representative of different levels of inferencing. Each distractor was scored 1 point for a response that matched the key and -1 for a response that did not match the key.

Perceived condition measure. To evaluate the effects of what students thought the purpose of the task was, a measure of perceived condition was constructed. After reading each passage, the students were told that they were going to be tested and they were asked to indicate what they thought they would be tested on. The choices were:

1. Important ideas from the story (article)
2. Facts from the story (article)
3. The meanings of the words from the story (article)
4. How well the author wrote the story (article)
5. How the story (article) made you feel
6. Other things; list them here:_____

The students were instructed to choose all of the responses they thought applied. On the Perceived Condition Measure, each response was scored 1 if the student chose it and 0 if the response was not chosen.

Procedures

One researcher met with the participating teachers, explained the study, and made arrangements to administer the tests. Three sessions were arranged for each participating classroom.

Pretesting. The students were tested in their normal classroom settings. For the pretest session, the students completed the yes/no test first and then the vocabulary pretest. A researcher and the students completed sample items together before the students began the tests. Individual questions about the procedures were answered, but questions about the words on the yes/no test or the meanings of the words on the vocabulary test were not answered. The students were allowed to take as much time as they needed to complete the tests. Each testing session lasted about 45 minutes.

The yes/no tests were scored immediately after the students completed them. Based on this general measure of verbal ability, the students in each classroom were ordered by rank and assigned to treatment conditions. Stratified random assignment by verbal ability to conditions within classrooms was used to control for ability differences in the conditions and classroom effects.

Posttesting. The posttest sessions took place at least 3 weeks after the pretest session. Each classroom participated in two posttest sessions. In each posttest session, each student read one passage and completed the perceived condition measure. After the passage and perceived condition measure were collected, the student completed the comprehension test for the passage just read, and then completed the posttest for the vocabulary from that passage as well as the vocabulary from the passage in that genre that was not read. The second posttest session was the same as the first, except that the student

read a passage in the other genre. In all, each student read one narrative and one expository passage with genre order counterbalanced.

Design and Analysis

Because the students took both pretests and posttests on their knowledge of the target vocabulary words, scores that were representative of the learning of vocabulary after the effects of the student's pretest knowledge had been taken into account were computed for use in the analyses. These residual gain scores (Gain) were computed in the following manner. First, regression analyses in which the dependent measure was the posttest score and the predictor was the pretest score were run. These regressions were run separately for each passage. The next step was to compute the Gain score using the constant (A) and slope coefficient (B) from the regressions. The Gain score was calculated by subtracting the quantity Constant (A) plus B times the pretest score from the posttest score:

$$\text{Gain} = \text{Posttest} - (\text{A} + \text{B} * \text{Pretest})$$

A separate Gain score was calculated for each student for each passage. This was done in order to control for passage effects because overall student performance varied by passage, and passage was essentially a nuisance variable in this study (see Table 2).

The data were analyzed using hierarchical multiple regression procedures following the logic of a mixed between-subject and within-subject analysis of variance. Several different analyses were conducted to answer the questions posed in this study.

[Insert Table 2 about here.]

For the analyses examining learning of vocabulary during reading under the six conditions, the dependent measure was the residual gain score for each target word from each passage for each subject. The between-subject factors were verbal ability (as measured by the checklist vocabulary test), sex, age, and the condition contrasts that represented comparisons between the conditions. Three condition contrasts were used in these analyses. Contrast 1 represents the comparison between only reading and focusing attention on words (Conditions 1 and 2 vs. Conditions 3, 4, 5, and 6). Contrast 2 represents the comparison between having the difficult words pre-underlined for the student and asking the student to underline the difficult words (Conditions 4 and 5 vs. Conditions 3 and 6). Contrast 3 represents the effect of asking the student to learn the difficult words (Conditions 5 and 6 vs. Conditions 3 and 4). The grand mean (a subject's mean performance on all vocabulary words using Gain scores) was calculated. The within-subject factor was passage access (whether the student read the passage or not). The total variance was partitioned in the following order: (a) the between-subject factors, (b) the grand mean, (c) passage access (PA), and (d) the interactions between the between-subject and within-subject factors. In these analyses, the interactions of greatest interest were condition by passage access and verbal ability by passage access. Since the condition contrasts were orthogonal, their order of entry did not affect one another, therefore, they were allowed to compete for order entry. In a first run, nonsignificant interactions were eliminated from the equation to avoid overfitting of the data in the final analyses. In these regression analyses, the F ratio for each step was calculated by dividing the increment in R^2 unique to that step by a more conservative error term to provide a stringent significance test. The error term is created by subtracting the total R^2 from the final step from 1 (yields $1 - R^2F$), and then dividing that quantity by the appropriate degrees of freedom ($N - K - 1$), where N equals the number of cases and K equals the number of steps in the final model.

$$\frac{R^2\text{step}}{\dfrac{(1 - R^2F)}{(N - K - 1)}}.$$

For the comprehension analyses, only data from the passages that the students read were included as there were no comprehension scores for passages that the student did not read. Separate analyses of these data were conducted using Gain and passage comprehension scores as the dependent measures.

RESULTS AND DISCUSSION

First, we provide the descriptive statistics followed by the analyses examining vocabulary learned during reading and the effects of the six conditions on learning of vocabulary from context during reading. The next set of analyses we provide focus on the relationship between passage comprehension and learning vocabulary from context during reading. In the final section, we discuss the analyses of the effects of word properties and perceived condition.

Descriptive Statistics

The means and standard deviations for each of the measures--verbal ability, vocabulary pretest, vocabulary posttest, residual gain score (Gain), and passage comprehension--are presented in Table 3. The pretest, posttest, and comprehension scores are reported in terms of mean proportion correct. The gain score represents the posttest vocabulary score after it has been adjusted for pretest knowledge of the words. These scores are reported for each condition by passage access (read passage, not read passage). There are no comprehension scores for passages that the students did not read because the students were only asked to complete comprehension questions for the passages that they read. The correlations among the measures are presented in Table 4. These moderate correlations are of the magnitude that would be expected among measures of verbal ability and performance. The correlation between pretest and posttest is higher, but this is consistent with the fact that what a person already knows is highly related to what he or she will learn during reading.

[Insert Tables 3 & 4 about here.]

Vocabulary Learning

Learning From Context

Table 5 presents regression analyses predicting the learning of vocabulary in which the dependent measure was the Gain score. Three condition contrasts were used in these analyses. Contrast 1 represents the comparison between only reading and focusing attention on words (Conditions 1 and 2 vs. Conditions 3, 4, 5, and 6). Contrast 2 represents the comparison between having the difficult words pre-underlined for the student and asking the student to underline the difficult words (Conditions 4 and 5 vs. Conditions 3 and 6). Contrast 3 represents the effect of asking the student to learn the difficult words (Conditions 5 and 6 vs. Conditions 3 and 4). In these regression analyses, the between-subject variables--verbal ability, sex, age, and the condition contrasts--were entered first, followed by the grand mean, the within-subject variable--passage access, and the interaction terms--passage access by the condition contrasts, ability by passage access, ability by the condition contrasts, and ability by passage access by the condition contrasts. The interactions of ability by condition contrasts and ability by passage access by condition contrasts are not included in the table since they did not account for any additional significant (alpha = .05) variance. The percent of variance refers to the increment in R^2 unique to that step. The F to enter refers to the test of significance of the variable at the step it entered

the equation. The Final *F* and Final *B* both refer to the final step in the analyses. The Final *F* is the test of significance and the Final *B* is the unstandardized regression coefficient.

As can be seen from Table 5, the grand mean, which was a student's mean performance on all words from both the read and not read passages, explained more variance than any other factor. The grand mean accounted for variance associated with all stable differences between students such as ability and motivation. After the variance associated with individual differences was removed from the equation, the effect of reading was still a significant predictor of vocabulary learning. Students knew significantly more of the target vocabulary as a result of reading a passage in which the words appeared. This finding is consistent with previous research on incidental acquisition of word knowledge during reading (Jenkins et al., 1984; Nagy et al., 1985; Nagy et al., 1987; Sternberg, 1987). The negative Final *B* for the Passage Access variable is reflective of the fact that the interactions between passage access and Conditions 1 and 2 are negative; however, the overall effect of reading is positive at the step in which it is entered.

[Insert Table 5 about here.]

Not only is the incidental learning of vocabulary during reading a robust finding, but the insignificant interaction of ability with reading indicates that children of all abilities learn vocabulary during reading. The presence of a significant main effect of ability indicates that high-ability children are better able to learn information about word meanings from the test contexts, which are contrived, than are low-ability children. While there is a positive correlation between ability and gain scores (.35), it is not of a magnitude that would suggest that incidental vocabulary learning does not occur at all levels. Children of all ability levels learn vocabulary equally well from normal reading of natural contexts. Figure 1 illustrates the interaction of ability with incidental acquisition of vocabulary knowledge. While the relationship between ability and vocabulary learning is not linear, the lines representing the posttest scores are parallel to the lines representing the corresponding pretest scores, indicating that the gains from pretest to posttest are similar for all children.

[Insert Figure 1 about here.]

Previous research on the relationship between ability and incidental vocabulary acquisition during reading is inconsistent. Some researchers have found a significant interaction between learning from context and ability (Herman et al., 1987; Jenkins et al., 1984) while others have not (Nagy et al., 1985; Nagy et al., 1987). One possible explanation for the lack of an ability by learning from context interaction in this study lies in the type of assessment used. The Contexts Test was designed to tap the students' levels of word knowledge to capture the relatively small changes in word knowledge that occur during reading. This type of assessment allowed students of all ability levels to receive credit for the knowledge that they actually gained, irrespective of their beginning or ending level of knowledge. For example, a student who began with a score of 0 on the pretest could receive credit for a gain of knowledge as indicated by a posttest score of 1; and a student who began with a pretest score of 3 and ended with a posttest score of 4 would also receive credit for that gain. Traditional tests generally give credit only for complete knowledge, which would be comparable to a score of 4 on the Contexts Test. Focusing on one level of vocabulary knowledge underestimates the learning of word meanings that actually occurs during reading. Figure 2 illustrates the percent of time that a student moved from a given pretest score to each possible posttest score. The numbers 0 to 4 across the bottom of each diagram indicate the pretest score for a word, and the numbers 0 to 4 in the left column of each diagram indicate the posttest score for a word. The numbers within each diagram represent the percentage of time that a student with a given pretest score on a word moved to a given posttest score for that word. For example, 28% of the time, a student with a pretest score of 1 on a word received a posttest score of 2 on that word after reading a passage in which the word was used. The numbers

in the boxes along the diagonal indicate the percent of time that the student's knowledge remained constant from pretest to posttest.

As can be seen from the figure, occasionally students scored lower on the posttest than on the pretest; however, the numbers generally are in the direction that would be expected. Small gains in knowledge are much more frequent than large changes in both the read and not read conditions. The fact that students gained knowledge about the words in the not read condition can be explained by considering the nature of the test. The words were presented in contexts that allowed the students to gain some knowledge from simply taking the test. It is also possible that taking the pretest sensitized the students to the target vocabulary words, and as a result students may have been more likely to learn about them as a result of encountering them in other settings. A third possibility is that the students may have talked about the words with each other or looked them up in a dictionary. However, the students gained more knowledge about the words in the read condition than in the not read condition, as would be expected. This figure illustrates the incremental nature of vocabulary acquisition during reading.

[Insert Figure 2 about here.]

Effects of Conditions

One of the primary questions driving this study was whether the instructions given to the students before reading would affect word learning during reading. The effects of the six conditions were explored in the regression analyses presented in Table 5. The effects of interest are the interaction terms of read by each of the condition contrasts. As can be seen in the table, none of the conditions accounted for a significant amount of the variance in learning the target vocabulary during reading (Gain). In addition, the interactions between the condition contrasts and ability were also not significant. Therefore, it must be concluded that focusing students' attention on words, either directly or indirectly, does not enhance learning of the words during reading. This was true across all ability levels.

These findings are not consistent with the results from previous studies on deriving word meanings from context (e.g., Carnine et al., 1984; Caroll & Drum, 1983; Sternberg, 1987) in which students were able to derive the meanings of target vocabulary words from context. Students' inability to derive word meanings from context in the present study may be related to the fact that the students did not have access to the passage when they were taking the vocabulary test. Perhaps students can demonstrate the ability to derive word meanings from context only when they see the context in which the word is used in conjunction with the test items for that word.

The next analyses were performed using only the data from the conditions in which the students were asked to underline the difficult vocabulary words (Conditions 3 and 6). The mean pretest and posttest scores for the target words the students underlined and did not underline are presented in Table 6. As can be seen from the table, the mean pretest scores for the words that the students underlined are much lower than the mean pretest scores for the words the students did not underline. This can be interpreted to mean that the students were able to identify which words they did not know.

[Insert Table 6 about here.]

The next question was, as students were able to identify unknown words, did this ability affect their learning of those words? Table 7 presents regression analyses predicting posttest scores using data from the conditions in which the students were asked to underline difficult vocabulary words (Conditions 3 and 6). In this regression analysis, pretest was entered first, followed by the ability measure and underlining. The variables representing the total number of words underlined, condition (3 or 6), and passage comprehension did not enter the equation because they did not account for significant (alpha = .05) additional variance. In these analyses, underlining had a small but statistically significant effect

on learning. However, it was negatively related to learning. In other words, students were less likely to learn words that they underlined than words that they did not underline. Overall, students did not underline many words. Fifty-one percent of the time students did not underline any of the words when they read the passages, and 84% of the time they underlined four or fewer words per passage. This, and the negative relationship to learning, may be due to the fact that the students were encountering the words in passages and only considered words to be unknown if their comprehension was affected. In fact, when they were taking the posttest, students asked if they should go back and underline words in the passage when they could not answer the posttest questions about the word. Many students said "I thought I knew the word when I was reading, but I guess I don't because I don't know the answer to this question." Apparently, the context of the passage was strong enough that the students did not perceive it as unknown while reading, but they did not have enough knowledge to answer specific questions about the word's meaning without the context supplied by the passage. It seems that students perceive words as unknown during reading only if the word causes comprehension to break down.

[Insert Table 7 about here.]

Comprehension Analyses

All comprehension analyses were computed using only the data from the passages that the students read because there were no comprehension scores on passages that were not read. Table 8 presents regression analyses predicting learning of vocabulary from context. In these analyses, comprehension was entered last in order to examine whether it accounted for additional variance after all sources of variance had been accounted for. No interactions accounted for significant (alpha = .05) additional variance, therefore they are not included in the table. After all other sources of variation had been accounted for, passage comprehension still accounted for a significant additional variance. The fact that the interactions of comprehension with condition and comprehension with ability were not significant indicates that the positive effect of comprehension was consistent across conditions and ability levels. Higher levels of passage comprehension were associated with more vocabulary learning for students of all ability levels irrespective of the condition to which they were exposed.

[Insert Table 8 about here.]

Because comprehension had a positive effect on vocabulary learning, a follow-up question was whether any of the other variables in the study affected passage comprehension. Table 9 presents regression analyses predicting passage comprehension. In these analyses, vocabulary pretest scores were entered first, followed by ability scores. The three condition contrasts were entered next, followed by the ability by condition contrasts. Pretest vocabulary scores accounted for a little over one third of the variance in the passage comprehension scores.

The more students knew about the words in the passage before reading it, the better the passage was comprehended. Unlike the previous analyses in which the conditions did not have a significant effect on vocabulary learning, the conditions did have a significant effect on passage comprehension. Students who were told to simply read or read and understand the passage (Conditions 1 and 2) had significantly higher comprehension scores than students in the other conditions (Condition Contrast 1). Focusing students attention on words, either directly or indirectly, interfered with their passage comprehension. In addition, asking students to underline the difficult words in the passage interfered more with comprehension than having the words pre-underlined (Condition Contrast 2).

[Insert Table 9 about here.]

Other Analyses

An additional regression analysis was performed to examine the effects of various word properties on learning vocabulary from context. The dependent measure in this analysis was the residual gain scores (Gain). The word variables were entered into the equation first--passage difficulty, mean contextual rating, number of occurrences of the word in the text, number of syllables, part of speech contrasts (noun vs. verb, adjective and adverb; verb vs. adjective and adverb; and adjective vs. adverb), conceptual category, conceptual difficulty, morphological complexity, proportion of conceptually difficult words per passage, and mean length of words in syllables for the passage (see Nagy, et al., 1987, for a complete description of the coding of these categories). The grand mean was entered next, followed by passage access (read vs. not read passages), followed by the interaction terms representing read by each of the word variables. In these analyses, only the interaction of part of speech Contrast 1 (nouns vs. verbs, adjectives, and adverbs) was significant. Nouns were easier to learn than any other part of speech. The results of this analysis were similar to those reported by Nagy, et al. (1987). The only variable they found to have a significant effect on learning from context was the conceptual difficulty of the words. That variable was not significant in the present study, probably because the range of conceptual difficulty was restricted. The fact that the part of speech Contrast 1 was significant in this study and not in the Nagy et al. (1987) study is probably due to the difference in the measures used for assessment. The Contexts Test included an item for each word in which it was used in a syntactically inappropriate way which is likely to be sensitive to knowledge of part of speech. The Nagy et al. (1987) study did not include this type of item.

A final set of analyses was run to evaluate the effects of what the students thought was the purpose of the task. Regression analyses were run using the Gain and the Comprehension scores as dependent measures and the responses to the perceived condition measure as the predictors. None of the perceived condition responses were significant predictors of the students' performance on either learning vocabulary or passage comprehension. However, as can be seen in Table 10, students in experimental Conditions 1 and 2 (read the passage or read and understand the important ideas) were more likely to choose important ideas and facts from the passage (perceived Conditions 1 & 2) as things they would be tested on than students in experimental conditions that focused their attention on words. Also, students in experimental conditions which focused attention on words (Experimental Conditions 3-6) were more likely to say they thought they would be tested about word meanings than students in Experimental Conditions 1 and 2. This indicates that the students were influenced by the directions they were given before reading the passages.

[Insert Table 10 about here.]

CONCLUSIONS

The results of this study support previous research findings that vocabulary knowledge is acquired incidentally during reading. In this study, the manipulations of the instructions given to students before reading did not influence their vocabulary learning during reading. Students of all ability levels increased their knowledge of the target vocabulary words as a result of reading passages in which the words appeared, regardless of the instructions they were given prior to reading.

Passage comprehension was related to vocabulary learning. Higher comprehension scores on the passage were related to increased vocabulary learning. While the instructions given to the students before reading did not influence vocabulary learning, these instructions did influence passage comprehension. Focusing students' attention on words appeared to interfere with passage comprehension. As a result, it must be concluded that the relationship between incidental vocabulary acquisition and reading is more complex than originally conceived. The relationships among the variables in this study are depicted in Figure 3. This path analysis illustrates the effects of key variables

on the posttest vocabulary scores. First, the relationships among verbal ability, pretest vocabulary scores, and posttest vocabulary scores are depicted on the outer part of the diagram. As can be seen by the path coefficients, verbal ability is strongly related to the pretest vocabulary scores, and the pretest scores are strongly related to the posttest scores. This indicates that high-ability students knew more about the target words to begin with and that they knew more about the words after reading the passages than low-ability students. This main effect of ability is also evidenced by the significant coefficient on the path from ability to the posttest. This represents the fact that high-ability students knew more words than low-ability children both before and after reading, but is not indicative of the amount of learning that took place as a result of reading. As can be seen in the regression analyses, there was no interaction between ability and amount of vocabulary learned (see Table 5). The absolute size of the gains in vocabulary knowledge (as measured by residual gain scores) were similar for students of all ability levels. The main effect of ability is simply a reflection of the amount of vocabulary knowledge individual students brought to the task, not a reflection of how much was actually learned during reading.

[Insert Figure 3 about here.]

The inner part of the diagram depicts the relationships among the effects of the conditions, passage comprehension, and the posttest scores after the effects of verbal ability and the pretest scores have been removed. As can be seen from the diagram, focusing students' attention on words during reading had virtually no direct effect on the posttest scores. However, it had a significant negative effect on passage comprehension which, in turn, had a significant positive effect on the posttest scores. Taken together, the negative effect of focusing attention on words on passage comprehension and the positive effect of comprehension on vocabulary learning account for the lack of a direct effect on vocabulary learning of simply focusing attention on words.

These findings can be explained by considering the idea that the primary goal of a reader is to construct a coherent mental model of the text (Anderson & Pearson, 1984; Anderson, Reynolds, Schallert, & Goetz, 1977). As a part of this process, the reader uses knowledge of the topic as well as information in the text to make inferences about missing or unknown information. In this way, the reader makes inferences about the meanings of unknown words that are consistent with the overall representation of the text being constructed. Thus, learning vocabulary may be thought of as a natural consequence of the reading comprehension process.

However, purposely focusing attention on individual words in a passage does not enhance word learning, and it interferes with passage comprehension. The most likely explanation for this is that emphasis on specific words during reading interferes with the construction of a coherent model of the text. This is consistent with the findings of previous research. Wagner and Sternberg (1984) found that training on forms of information processing that students had automatized interfered with their performance. In fact, the idea that focusing on specific elements of a passage, such as individual words, impedes understanding of the text can be traced back to Thorndike (1917), who attributed failures in reading to the practice of focusing poor readers' attention on reading individual words (what he called the "overpowering" of specific words), which prevented them from making the mental connections necessary to understand the ideas being presented in the text.

These findings bring into question the fairly widespread practice found in many textbooks of underlining or highlighting the difficult or new vocabulary in their textbook selections. The findings of this study do not support this procedure as a helpful way to enhance either vocabulary learning or reading comprehension.

Another issue that is relevant to the findings from this study is the relationship between vocabulary acquisition during reading and verbal ability. Sternberg and Powell (1983) have hypothesized that learning from context is contingent upon a person's intelligence, and other researchers have found ability

to be significantly related to learning from context (Herman et al., 1987; Shefelbine, 1990). However, the findings from this study, as well as others (Nagy et al., 1985; Nagy et al., 1987), support the idea that learning vocabulary from context is something that students of all ability levels are capable of doing. One explanation for the inconsistency of results across studies lies in the nature of the assessment tools used. Vocabulary acquisition seems to be incremental in nature, and assessments that tap only one level of knowledge are not sensitive to small changes in knowledge. However, the Contexts Test used in this study enabled students to be given credit for even small gains in knowledge. Under these conditions, the relative size of the gain in vocabulary knowledge was similar for students of all ability levels. The Contexts Test was evidently a sensitive indicator of levels of word knowledge and was also sensitive to the effects of reading.

In conclusion, the results of this study support the belief that vocabulary knowledge is acquired incidentally during reading by students of all ability levels. However, purposely focusing attention on words during reading underminded students' comprehension, probably by distracting them from building a coherent representation of the text. This should cause educators as well as textbook publishers to rethink the practice of purposely focusing attention on words during reading.

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Table 1

School and District Demographic Data

	School A	School B	School C	School D	District
Ethnicity					
White (Non-Hispanic)	58.0%	57.1%	65.7%	58.1%	66.9%
Black	31.7%	39.4%	29.6%	37.0%	27.6%
Hispanic	6.5%	3.5%	4.5%	3.6%	3.5%
Total Enrollment	805	287	335	303	7075
Low-Income	61.2%	58.2%	61.2%	47.9%	39.9%
Attendance Rate	95.1%	93.0%	94.9%	95.3%	92.8%
Student Mobility	27.4%	25.6%	47.2%	35.5%	27.5%
Non-Promotion Rate	6.6%	2.8%	4.4%	3.5%	2.9%

Table 2

Means and Standard Deviations on Each Measure by Passage

Passage	Ability	Pretest	Posttest	Gain	Comp.
1	62.44 (14.77)	.42 (.24)	.53 (.28)	.03 (.14)	.58 (.23)
2	63.10 (12.08)	.17 (.15)	.27 (.21)	.03 (.13)	.31 (.22)
3	62.28 (13.84)	.47 (.25)	.57 (.28)	.03 (.14)	.50 (.24)
4	63.21 (13.24)	.31 (.21)	.41 (.26)	.03 (.15)	.36 (.25)

Table 3

Means and Standard Deviations for Scores by Passage Access and Condition

	Ability	Pretest	Posttest	Gain	Comp.
Read	61.04 (13.64)	.35 (.24)	.49 (.28)	.03 (.14)	.45 (.26)
Cond. 1	61.07 (11.78)	.44 (.22)	.57 (.23)	.03 (.12)	.54 (.23)
Cond. 2	60.33 (15.65)	.37 (.24)	.51 (.27)	.05 (.14)	.49 (.23)
Cond. 3	60.50 (12.99)	.31 (.25)	.44 (.28)	.01 (.13)	.40 (.26)
Cond. 4	61.58 (11.51)	.31 (.24)	.47 (.28)	.04 (.11)	.42 (.25)
Cond. 5	61.87 (12.69)	.33 (.24)	.46 (.29)	.01 (.15)	.37 (.28)
Cond. 6	60.93 (15.93)	.34 (.24)	.48 (.28)	.02 (.16)	.48 (.26)
Not Read	61.04 (13.64)	.33 (.39)	.41 (.28)	-.03 (.16)	
Cond. 1	61.07 (11.78)	.39 (.24)	.46 (.25)	-.02 (.11)	
Cond. 2	60.33 (15.65)	.35 (.25)	.39 (.29)	-.03 (.17)	
Cond. 3	60.50 (12.99)	.29 (.24)	.37 (.27)	-.05 (.16)	
Cond. 4	61.58 (11.51)	.33 (.23)	.43 (.27)	-.003 (.17)	
Cond. 5	61.87 (12.69)	.30 (.26)	.42 (.30)	-.02 (.12)	
Cond. 6	60.93 (15.93)	.34 (.26)	.42 (.27)	-.04 (.18)	
Total	61.04 (13.63)	.34 (.24)	.45 (.28)	-.0002 (.15)	.22 (.29)

Table 4

Correlations among the Measures

	Ability	Pretest	Posttest	Gain
Pretest	.53*			
Posttest	.54*	.86*		
Gain	.20*	.04	.54*	
Comp.	.35*	.59*	.58*	.17*

*$p < .01$.

Table 5

Regression of Vocabulary Gains on Student Traits and Conditions of Reading

Variable	% of Variance	*F t* Enter	Final *F*	Final *B*
Between Subject Ability	2.63	22.32*	.30	.0004
Sex	.02	.15	.99	-.00003
Age	.30	2.56	.99	.00005
Condition Contrast 1	.08	.68	.34	.03
Condition Contrast 2	.33	2.76	.29	-.03
Condition Contrast 3	.10	.58	.65	.01
Within Subject Grand Mean	41.19	379.09*	415.41*	.99
Read	3.28	51.58*	.85	-.03
Read X Contrast 1			1.04	-.02
Read X Contrast 2			1.26	-.02
Read X Contrast 3			.23	.009
Read X Ability			.51	-.0003
Constant	.05			
Multiple R	.69			
Total Variance Explained	48.11			

*$p < .05$.

Table 6

Means and Standard Deviations of Pretest and Posttest Scores by Underlining

	Pretest	Posttest
Words Underlined	.08 (.33)	.19 (.38)
Words Not Underlined	.31 (.46)	.43 (.48)

Table 7

Regression of Posttest Vocabulary on Effects of Student Underlining

Variable	% of Variable	Final *F*	Final *B*
Pretest	25.7	691.42*	.46
Ability	4.41	188.04*	.008
Underlining	.44	17.86*	-.08
Passage Comprehension		3.80	
Condition		.07	
Total Words Underlined		.002	
Constant	3.11		
Multiple *R*	.55		
Total Variance Explained	30.72		

Table 8

Regression of Vocabulary Gains on Student Traits, Conditions, and Passage Comprehension Using Read Data

Variable	% of Variance	Final *F*	Final *B*
Ability	4.8	11.70*	.002
Age	.02	.09	.004
Sex	.01	.07	.002
Condition Contrast 1		.02	.003
Condition Contrast 2	.78	1.68	.02
Condition Contrast 3		1.84	-.02
Text Contrast 1			-.0001
Text Contrast 2		.03	.001
Text Contrast 3	.05	1.27	-.02
Comprehension 1	.60	3.33*	.06
Constant	-.13		
Multiple *R*	.25		
Total Variance Explained	6.4%		

*$p < .05$.

Table 9

Regression of Passage Comprehension on Student Traits and Conditions Using Read Data

Variable	% of Variance	Final *F*	Final *B*
Pretest	35.1	137.79*	.59
Ability	.14	1.36	.001
Condition Contrast 1	1.0	6.57*	.08
Condition Contrast 2	.60	3.83*	-.05
Condition Contrast 3	.07	.40	.18
Ability by Contrast 1		3.34	
Ability by Contrast 2		.002	
Ability by Contrast 3		1.99	
Constant	12.60		
Multiple R	.61		
Total Variance Explained	36.9%		

*$p < .05$.

Table 10

Percent of Students Choosing Each Perceived Condition for Each Experimental Condition

	Experimental Conditions					
Perceived Conditions	1	2	3	4	5	6
1. Important ideas	72	80	63	56	59	61
2. Facts	69	78	61	59	58	61
3. Word Meanings	39	42	52	62	65	57
4. Author's Craft	4	19	14	9	13	11
5. Like the Passage	44	44	45	35	33	39
6. Other	16	21	18	18	14	12

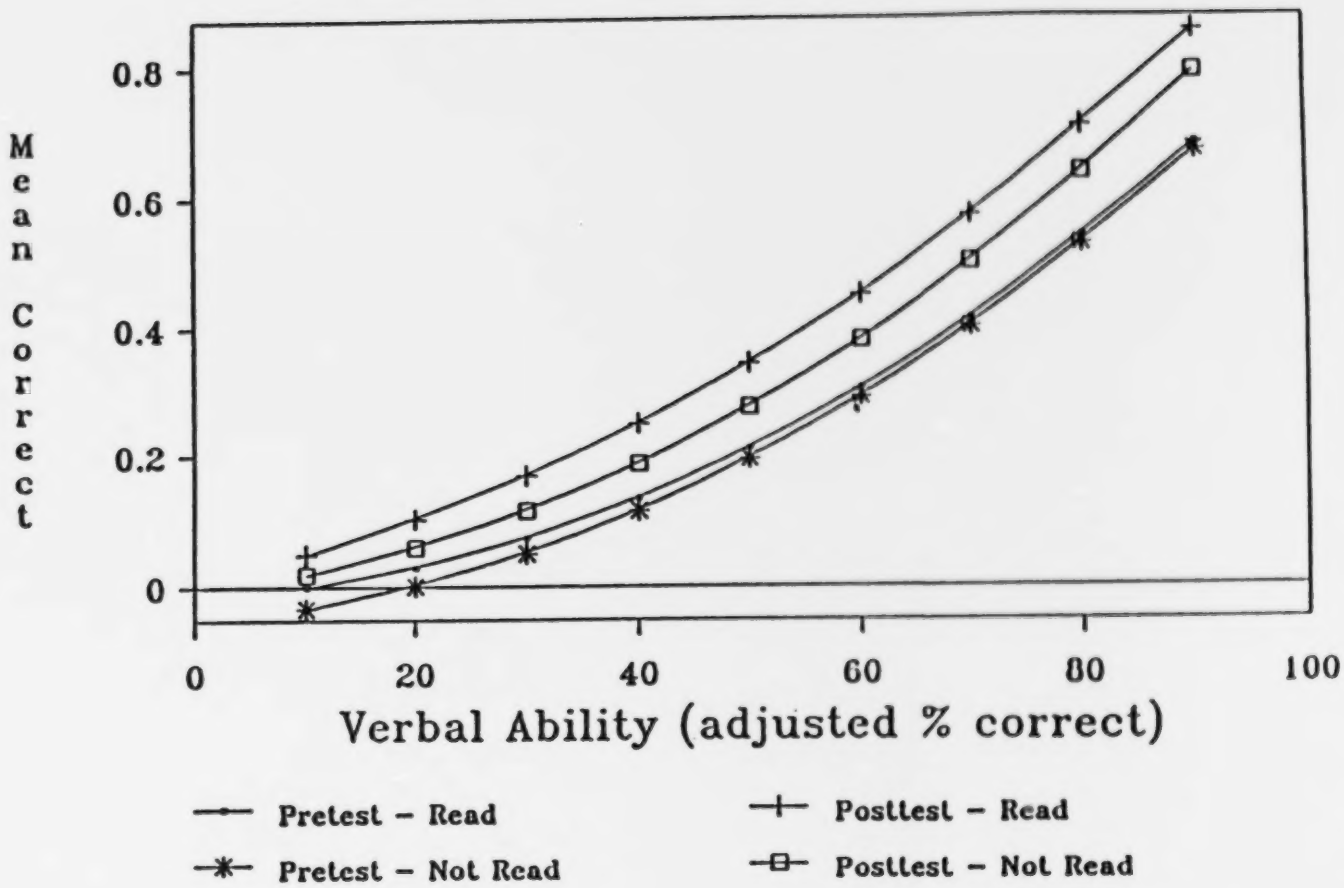


Figure 1. Interaction of Learning from Context and Ability

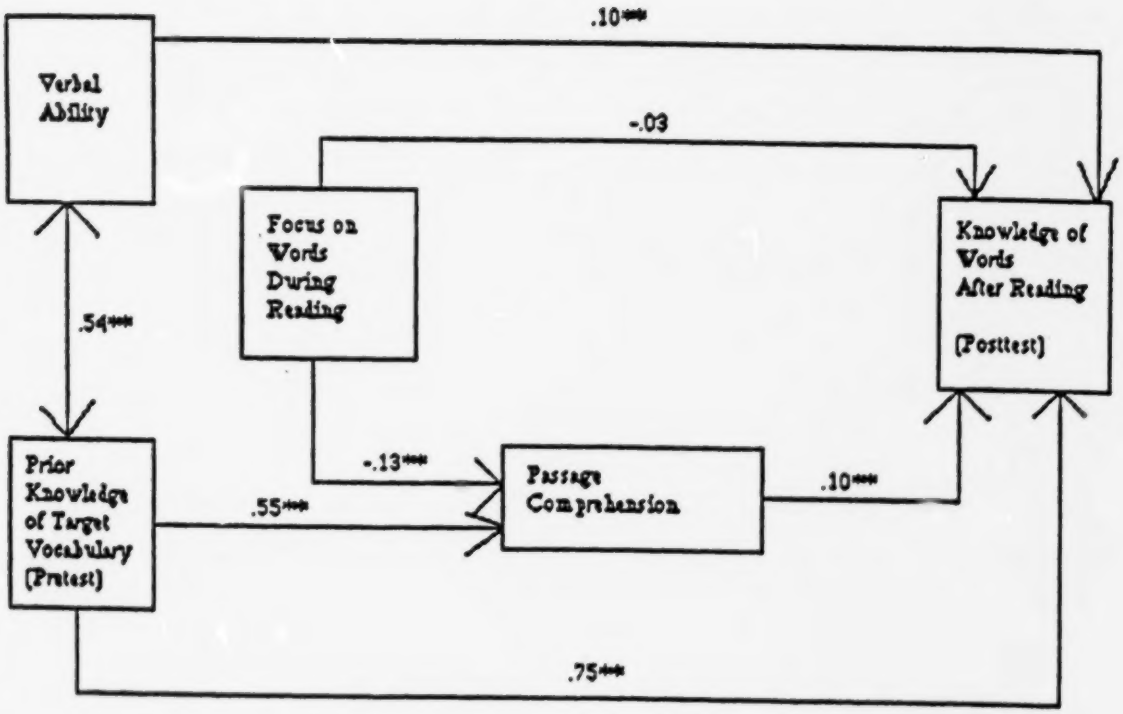
Passage Read

	4	7.5	12.9	23.7	45.0	79.4
P	3	14.5	20.9	27.7	33.6	15.8
O	2	19.2	28.0	25.0	14.1	3.7
S	1	24.8	24.4	16.5	5.5	0.9
T	0	34.1	13.8	7.7	1.8	0.1
		0	1	2	3	4
	n	1284	1350	1344	1320	1291
			P	R	E	

Passage Not Read

	4	4.8	10.2	20.9	38.8	74.6
P	3	8.7	15.6	27.2	34.8	17.8
O	2	19.3	29.8	26.2	15.4	5.1
S	1	25.1	26.3	17.0	7.5	2.0
T	0	42.0	18.0	8.7	3.5	0.5
		0	1	2	3	4
	n	1242	1230	1236	1206	1182
			P	R	E	

Figure 2. Pretest to Posttest Change in Vocabulary Knowledge (% per Column)



***p<.001

Figure 3. Model of the Relationship Among Variables Influencing Learning of Vocabulary

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